AD_____

Award Number: W81XWH-06-1-0334

TITLE: Barriers to Breast Cancer Screening Among Latinas in the U.S.-Mexico Border Region

PRINCIPAL INVESTIGATOR: Jose A. Pagan

CONTRACTING ORGANIZATION: University of Texas-Pan American
Edinburg, Texas 78539

REPORT DATE: May 2008

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
01-05-2008	Annual	1 MAY 2007 - 30 APR 2008

4. TITLE AND SUBTITLE

Barriers to Breast Cancer Screening Among Latinas in the U.S.-Mexico Border Region

5a. CONTRACT NUMBER

5b. GRANT NUMBER
W81XWH-06-1-0334

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Jose A. Pagan

E-Mail: jpagan@utpa.edu

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

University of Texas-Pan American
Edinburg, Texas 78539

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The purpose of this project is to establish a research and training collaborative partnership between the Institute for Population Health Policy (IPHP) at the University of Texas-Pan American (UTPA) and the Leonard Davis Institute of Health Economics (LDI) at the University of Pennsylvania (Penn). Our objectives and scope are: to develop a competitive and successful breast cancer research program that focuses in cancer control and population sciences at UTPA; to develop and complete a research project on barriers to breast cancer screening among Latinas in the U.S.-Mexico border region; to develop the research infrastructure that will enable UTPA investigators to submit competitive breast cancer research proposals. The key accomplishments during the second year of the project are: the collection of most of the survey data on mammography screening practices; acceptance in a peer reviewed journal of a manuscript on health insurance coverage and mammography screening; and securing a federal grant to further develop health services research at UTPA in collaboration with Penn.

15. SUBJECT TERMS
Breast cancer screening; Latinas

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			USAMRMC
U	U	U	UU	12	**19b. TELEPHONE NUMBER** *(include area code)*

Table of Contents

INTRODUCTION

The subject/purpose of this project is to establish a research and training collaborative partnership between the Institute for Population Health Policy (IPHP) at the University of Texas-Pan American—a Minority Institution—and the Leonard Davis Institute of Health Economics (LDI) at the University of Pennsylvania (Penn). The UTPA-Penn breast cancer research/training partnership focuses on understanding and ameliorating disparities in breast cancer screening among Latinas in the U.S.-Mexico border region. Our objectives and scope are (1) to develop a competitive and successful breast cancer research program that focuses in cancer control and population sciences at UTPA; (2) to develop and complete a research project on barriers to breast cancer screening among Latinas in the U.S.-Mexico border region; (3) to develop the research infrastructure that will enable UTPA investigators to submit competitive breast cancer research proposals.

BODY

The Statement of Work for the project includes the following three tasks:

(1) Develop a competitive and successful breast cancer research program that focuses in cancer control and population sciences at UTPA (Years 1 and 2)
(2) Develop and complete a research project on barriers to breast cancer screening among Latinas in the U.S.-Mexico border region (Years 3 and 4)
(3) Develop the research infrastructure that will enable UTPA investigators to submit competitive breast cancer research proposals (Year 4)

We have been able to accomplish our set goals and objectives during the second year of the project. Our task for the first two years of the project involves the development of a competitive and successful breast cancer research program that focuses in cancer control and population sciences at UTPA. During Year 2 we were able to complete our survey instrument on breast cancer screening and on 23 July 2007 we received approval to conduct our study from the Institutional Review Board at UTPA. The protocol was reviewed by the USAMRMC's Office of Research Protections (Human Research Protection Office) and found to comply with applicable Federal, DOD, U.S. Army, and USAMRMC human subjects protection requirements (approved 24 July 2007; HRPO Log Number A-13729). During the past year we hired and trained ten interviewers and have completed 520 interviews. We expect to complete all interviews by the end of June 2008. As discussed in our proposal, study participants are being selected from the Border Epidemiologic Study on Aging (BESA), a longitudinal survey of Latino/a adults in South Texas. Although we have been very successful contacting participants from latter cohorts (2001 to 2005) to participate in our study, we have not had as much success with participants from earlier cohorts. Nonetheless, we expect to be reasonably close to achieving our goal of 877 completed interviews by the end of June 2008.

Over the last year we have kept in close consultation with our main Penn collaborators (Drs. Asch, Armstrong and Guerra) in terms of research project guidance, mentoring and collaboration. Our Penn collaborators worked with us to put together all the documentation required for IRB approval and they have also worked with us in several research initiatives. More specifically, in our Year 1 report we mentioned a manuscript we had been working on about how the size of the uninsured population in local communities is related to breast cancer screening. The paper was recently accepted in the *Journal of Clinical Oncology* and it appeared in print in April 2008 (see Appendix). Dr. Pagán will present this paper in poster and conference sessions—as well as a progress report of the research initiatives—in the DOD/BCRP Era of Hope Meeting in Baltimore, Maryland in 25-28 June 2008.

Our tasks also involve the development of research infrastructure at UTPA that will enable investigators to submit competitive research proposals. In our first annual report last year we discussed the submission of an R24 proposal to the Agency for Healthcare Research and Quality (AHRQ) to develop a health services research program at UTPA. This grant proposal was funded for three years ($1.47 million) and work on the subprojects began 1 September 2007. The grant runs until 31 August 2010. The AHRQ Minority Research Infrastructure Support Program (M-RISP) seeks to develop a Health Services Research (HSR) Initiative within the UTPA Institute for Population Health Policy (IPHP) to strengthen the research environment at UTPA and to enhance the competitiveness of faculty members in health services research. The research activities being undertaken under the HSR Initiative primarily focus on health disparities and health care utilization/access for priority populations—more specifically, low-income minority populations in the U.S.-Mexico border and the uninsured. The HSR Initiative also takes full advantage of the ongoing collaborative partnership through this DOD-funded research/training initiative between the IPHP and the Leonard Davis Institute (LDI) of Health Economics at the University of Pennsylvania. The LDI is providing technical expertise, mentoring and support to the HSR Initiative. The Specific Aims of the M-RISP are: (1) to develop a Health Services Research Initiative at UTPA, (2) to enhance the capacity of individual faculty members to undertake health services research, with a focus on research in low-income minority populations and the uninsured, and (3) to develop and foster research dedicated to reducing health and health care access disparities among Latino populations, particularly in the U.S.-Mexico border region. The HSR Initiative is providing support to four individual investigator research projects which address community uninsurance and health care access, the use of health care services in the U.S.-Mexico border region, severe weather and health care use by low-income and uninsured vulnerable populations, and the cost-effectiveness and net-benefits of school-based health promotion programs. The HSR Initiative is also actively promoting the development of research projects by junior faculty and graduate students focusing on the U.S. Latino population. These projects are consistent with the goals and objectives of not only AHRQ and the UTPA-IPHP HSR Initiative but also with the goals and objectives of this HBCU/MI Partnership Training Award.

Over the last year we also had other opportunities to continue joint collaborative efforts in cancer research with Penn investigators. More specifically, two papers were accepted for publication in the journal *Medical Decision Making*:

Chao, Li-Wei, José A. Pagán and Beth J. Soldo. (2008). "End-of-Life Medical Treatment Choices: Do Survival Chances and Out-of-Pocket Costs Matter?" *Medical Decision Making,* forthcoming.

Guerra, Carmen E., Phyllis A. Gimotty, Judy A. Shea, José A. Pagán, J. Sanford Schwartz and Katrina Armstrong. (2008). "Effect of Guidelines on Primary Care Physician Use of PSA Screening: Results from the Community Tracking Study Physician Survey," *Medical Decision Making*, forthcoming.

These two papers were revised, completed and accepted for publication over the last year, and DOD support is gratefully acknowledged and noted.

KEY RESEARCH ACCOMPLISHMENTS

- Completion of a survey instrument and a consent form for a mammography screening survey of Latinas in the US/Mexico border region.

- Approval of research protocol by the IRB at UTPA as well as the USAMRMC's Office of Research Protections (Human Research Protection Office; HRPO Log Number A-13729).

- Development, revision and acceptance of a manuscript on community uninsurance and breast cancer screening in the *Journal of Clinical Oncology* (published in April 2008; coauthors included Drs. Pagán and Brown from UTPA and Drs. Asch, Armstrong and Guerra from Penn, all collaborators in this HBCU/MI Partnership Training Award).

- Receipt of a three-year $1.47 million research grant from the Agency for Healthcare Research and Quality (M-RISP: Minority-Research Infrastructure Support Program). This project began September 2007. Penn is the partnering institution and obtaining this grant would not have been possible without the support of this HBCU/MI Partnership Training Award.

- Development of two manuscripts on cancer research with collaborators from Penn.

REPORTABLE OUTCOMES

Manuscripts

Pagán, José A., David A. Asch, Cynthia J. Brown, Carmen E. Guerra and Katrina Armstrong. (2008). "Lack of Community Insurance and Mammography Screening Rates among Insured and Uninsured Women," *Journal of Clinical Oncology*, **26**(11), 1865-1870.

Chao, Li-Wei, José A. Pagán and Beth J. Soldo. (2008). "End-of-Life Medical Treatment Choices: Do Survival Chances and Out-of-Pocket Costs Matter?" *Medical Decision Making*, forthcoming.

Guerra, Carmen E., Phyllis A. Gimotty, Judy A. Shea, José A. Pagán, J. Sanford Schwartz and Katrina Armstrong. (2008). "Effect of Guidelines on Primary Care Physician Use of PSA Screening: Results from the Community Tracking Study Physician Survey," *Medical Decision Making*, forthcoming.

Grant awarded (Agency for Healthcare Research and Quality; Grant Number R24HS017003; 9/1/2007 – 8/31/2010)

UTPA Health Services Research Initiative

The University of Texas-Pan American (UTPA) is the second largest Hispanic Serving Institution in the U.S. and it educates more Mexican American students than any other institution of higher education in the country. UTPA serves the educational needs of one of the poorest regions in the U.S.—the U.S.-Mexico border communities located in the Rio Grande Valley of South Texas. According to The University of Texas-Pan American Compact with the University of Texas System, the highest priority long-term initiative of UTPA for the next ten years is to become the doctoral research university of South Texas. In order to achieve this objective, UTPA is interested in developing new graduate degree programs and in increasing the research capacity and productivity of its faculty, especially in areas of regional strategic significance such as health services research. This AHRQ M-RISP application seeks to develop a Health Services Research (HSR) Initiative within the UTPA Institute for Population Health Policy (IPHP) to strengthen the research environment at UTPA and to enhance the competitiveness of faculty members in health services research. The research activities to be undertaken under the HSR Initiative primarily focus on health disparities and health care utilization/access for priority populations—more specifically, low-income minority populations in the U.S.-Mexico border and the uninsured. The HSR Initiative also takes advantage of an ongoing collaborative partnership between the IPHP and the Leonard Davis Institute (LDI) of Health Economics at the University of Pennsylvania. The LDI will provide technical expertise, mentoring and support to the proposed HSR Initiative. The Specific Aims of this M-RISP application are: (1) to develop a Health Services Research Initiative at UTPA, (2) to enhance the capacity of individual faculty members to undertake health services research, with a focus on research in low-income minority populations and the uninsured, and (3) to develop and foster research dedicated to reducing health and health care access disparities among Latino populations, particularly in the U.S.-Mexico border region. The HSR Initiative will support four individual

investigator research projects which deal with community uninsurance and health care access, the use of health care services in the U.S.-Mexico border region, severe weather and health care use by low-income and uninsured vulnerable populations, and the cost-effectiveness and net-benefits of school-based health promotion programs. The proposed HSR Initiative will also actively promote the development of research projects by junior faculty and graduate students which focus on the U.S. Latino population and are consistent with the goals and objectives of both AHRQ and the UTPA-IPHP HSR Initiative.

CONCLUSION

The development of a research and training collaborative partnership between the Institute for Population Health Policy (IPHP) at the University of Texas-Pan American and the Leonard Davis Institute of Health Economics (LDI) at the University of Pennsylvania (Penn) has been very successful during the second year of this project. The partnership has allowed UTPA researchers to improve their research skills, particularly in the areas of survey instrument development, design of research protocols, data collection, and manuscript and research proposal writing. The outcomes from this collaboration includes several joint manuscripts, a funded federal grant proposal, and the collection of data on mammography screening practices among Latinas in US/Mexico border communities that will allow this collaboration to further develop over the next few years. We believe that we are successfully developing a breast cancer research program and that we are getting closer to developing the research infrastructure which will enable UTPA investigators to submit competitive breast cancer research proposals.

REFERENCES

NA

APPENDICES

Appendix A

Reprint of Pagán, José A., David A. Asch, Cynthia J. Brown, Carmen E. Guerra and Katrina Armstrong. (2008). “Lack of Community Insurance and Mammography Screening Rates among Insured and Uninsured Women,” *Journal of Clinical Oncology*, **26**(11), 1865-1870.

VOLUME 26 · NUMBER 11 · APRIL 10 2008

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Lack of Community Insurance and Mammography Screening Rates Among Insured and Uninsured Women

José A. Pagán, David A. Asch, Cynthia J. Brown, Carmen E. Guerra, and Katrina Armstrong

From the Department of Economics and Finance and Institute for Population Health Policy, College of Business Administration, University of Texas-Pan American, Edinburg, TX; Leonard Davis Institute of Health Economics; Division of General Internal Medicine, School of Medicine, University of Pennsylvania; Center for Health Equity Research and Promotion, Philadelphia VA Medical Center, Philadelphia, PA.

Submitted September 26, 2007; accepted January 10, 2008.

Supported by the Department of Defense Breast Cancer Research Program under award number W81XWH-06-1-0334.

Authors' disclosures of potential conflicts of interest and author contributions are found at the end of this article.

Views and opinions of, and endorsements by, the authors do not reflect those of the US Army or the Department of Defense.

Corresponding author: José A. Pagán, PhD, Department of Economics and Finance, College of Business Administration, University of Texas-Pan American, 1201 W University Drive, Edinburg, TX 78539; e-mail: jpagan@utpa.edu.

0732-183X/08/2611-1865/$20.00

DOI: 10.1200/JCO.2007.14.5664

ABSTRACT

Purpose
To evaluate whether the proportion of the local population without health insurance coverage is related to whether women undergo mammography screening.

Methods
Survey data on 12,595 women 40 to 69 years of age from the 2000 to 2001 Community Tracking Study Household Survey were used to analyze the relation between community lack of insurance and whether the respondent had a mammogram within the past year.

Results
Women age 40 to 69 were less likely to report that they had a mammogram within the last year if they resided in communities with a relatively high uninsurance rate, even after adjusting for other factors. After adjusting for individual insurance and other factors, a 10-percentage-point decrease in the proportion of the local insured population is associated with a 17% (95% CI, 13% to 21%) decrease in the odds that a woman age 40 to 69 years will undergo mammography screening within a year.

Conclusion
Women living in communities with high uninsurance are substantially less likely to undergo mammography screening. These results are consistent with the view that the negative impact of uninsurance extends to everyone in the community regardless of individual health insurance status.

J Clin Oncol 26:1865-1870. © 2008 by American Society of Clinical Oncology

INTRODUCTION

About 47 million people in the United States do not have health insurance coverage, and the number of uninsured will keep rising if health insurance premiums continue to grow faster than earnings.[1-3] Lack of insurance clearly has a direct affect on the health of the uninsured population. The general health status of uninsured adults tends to decrease faster than that of insured adults, and uninsured adults have a higher risk of dying prematurely than do insured adults.[4] Many studies have shown that uninsured adults are more likely to lack access to health care and receive lower-quality health care—including preventive care—than are insured adults.[4,5] Lack of health insurance coverage has also been linked to delays in the detection of breast cancer and a threefold decrease in the probability of undergoing routine mammography screening.[6,7,8]

Lack of insurance may also be associated with reduced care for the surrounding insured population if high levels of community uninsurance create financial stress on local health care systems. There is substantial variation in the relative size of the uninsured population across communities and states in the United States.[9,10] For example, uninsurance rates can range from 5% to 10% in communities in Pennsylvania and New York to 25% to 35% in communities in California and Texas. Health care providers located in communities with a large uninsured population may have few sources of revenue, inducing them to reduce the mix, quantity, and quality of health services provided. Public safety-net providers may also be forced to limit health care services because regional governments may be unable to provide health care for a large uninsured population.[11]

Mammography services may be particularly sensitive to community insurance rates for several reasons. Reimbursement for mammography services has declined substantially during the last 10 years and, as such, providing screening mammography can be a financial liability for a health system or free-standing radiology facility.[12] Furthermore, mammography's capital-intensive cost structure makes mammography facilities financially sensitive

to changes in the demand for their services. The US Food and Drug Administration (FDA) has estimated that average costs decrease until "about the 80th percentile of the [mammography] volume distribution observed among U.S. [screening] facilities, so that most facilities operate at inefficient scale."[13] That is, mammography screening facilities must operate near full capacity to cover their fixed costs. If uninsured individuals are more likely to forego preventive services, high levels of community uninsurance may decrease the volume of services delivered by mammography facilities and effectively increase the average costs of providing screening services.[4,13]

Mammography use may also be particularly sensitive to community uninsurance because of the growing shortage of breast radiologists and certified mammography technologists. If radiologists and technologists are in high demand, they may be unlikely to locate in communities where the profit from and the demand for screening mammography is relatively low. Supporting this hypothesis, a 2001 to 2002 survey indicated that the radiologist shortage was greater in nonprofit facilities and that facilities reporting lower rates of mammograms also appear to have the most difficulty retaining certified technologists.[14] Recent evidence also suggests that the number of mammography facilities in the United States is declining. The FDA reported 8,832 certified facilities with 13,399 accredited units as of September 1, 2007, a decline of 480 mammography facilities compared with October 2002.[15] This consolidation may further limit access to mammography screening and is likely to continue as existing mammography units are updated to digital imaging machines, which provide higher-quality images and computer-assisted diagnosis but at a higher cost.[16]

The purpose of this study is to examine whether low rates of community insurance are associated with reduced use of mammography screening for both insured and uninsured adult women. Survey data from the 2000 to 2001 Community Tracking Study Household Survey (CTSHS) is used to estimate multilevel logistic regression models of the determinants of mammography screening. Multilevel statistical modeling accounts the contextual effects of local-level lack of insurance and allows for the inclusion of community-specific random effects.[17] The main hypothesis of the study is that both insured and uninsured women residing in communities with a relatively large uninsured population are less likely to undergo mammography screening than if they resided in communities with a relatively small uninsured population.

METHODS

Data Source

The 2000 to 2001 CTSHS (N = 59,725) was developed to track changes in local health care systems, and the sample collected is representative of households in the 48 contiguous states.[18] The CTSHS includes information on household composition, demographic and socioeconomic characteristics, health status, health care utilization and personal experiences with the US health care system. Interviews were conducted from September 2000 to September 2001.

Fifty-one metropolitan areas and nine nonmetropolitan areas in the contiguous US were selected at random, and respondent households were drawn from these communities using random-digit dialing. This telephone sample was augmented with a sample of households that did not have a phone. Larger samples were drawn from 12 communities selected for more in-depth analyses. These communities were Boston, MA; Cleveland, OH, Greenville, SC; Indianapolis, IN; Lansing, MI; Little Rock, AK; Miami, FL; Newark, NJ; Orange County, CA; Phoenix, AZ; Seattle, WA; and Syracuse, NY. The selected sites are defined as local health care markets in the sense that this is where residents within the boundaries of these communities receive their health care, whereas providers mostly serve residents living in these communities. Most of the sites are metropolitan statistical areas defined by the US Office of Management and Budget and nonmetropolitan economic areas defined by the US Bureau of Economic Analysis.[18]

Individuals in households selected for interviews were classified into family insurance units (ie, family groupings consisting of an adult household member, his/her spouse and dependent children under the age of 18, or any dependent children who were full-time students between the ages of 18 and 22 years).[18] We used only the core CTSHS data (60 sites) because we were interested in estimating the proportion of the adult population without health insurance coverage residing in each site (ie, the uninsured population 18 years of age and older). After estimating community-level uninsurance rates, we further restricted the sample to women 40 to 69 years of age (n = 13,438). We also excluded a supplemental sample of 773 residents living outside the 60 CTSHS sites as well as 70 respondents with missing data in our variables of interest. Our final sample consisted of 12,595 women.

Variables

We analyzed how the proportion of the local population without health insurance coverage was related to mammography screening among both insured and uninsured women. We calculated the proportion of the local uninsured population in each of the 60 CTSHS sites using person-level sampling weights specifically developed for community-level estimates.[18] We determined individual insurance status by responses to the following question: "According to the information we have, [NAME] does not have health care coverage of any kind. Does [NAME] have health insurance or coverage through a plan I might have missed?" Those answering no to this question are classified as uninsured. All persons covered by private insurance, Medicare, Medicaid, military, state, or other plans are classified as insured. Extant research has shown that self-reported telephone survey data of health insurance status are accurate and valid.[19,20]

Our dependent variable was defined as whether the respondent reported she had a mammogram within the past year, constructed from answers to the following two questions: "A mammogram is an x-ray of the breast to look for breast cancer. Has [NAME] ever had a mammogram?" The question was asked to all women age 40 or older. If the answer was yes then there was a follow-up question: "How long has it been since [NAME] had (her/your) last mammogram?" Previous studies have shown that self-report is a valid method of collecting mammography data.[21-23]

Our specification of the multilevel logistic regression model for mammography screening was based on the idea that the use of preventive health care is determined by the need for preventive health care services, individual predisposing characteristics, enabling factors at the individual level, and community contextual factors.[24,25] Need variables included self-reported health status (fair, poor, good, very good, and excellent) and whether the respondent had zero, one, or two or more chronic health conditions (diabetes arthritis, asthma, chronic obstructive pulmonary disease, hypertension, coronary heart disease, cancer, or depression). Individual predisposing characteristics included three age categories (40 to 49, 50 to 59, and 60 to 69 years of age), four education categories ($\leq$ 11, 12, 13-15, and $\geq$16 years), racial/ethnic background (white, African American, Hispanic, or other), and whether the respondent was married. Enabling factors at the individual level included health insurance coverage and four family poverty level categories (0% to 99%, 100% to 199%, 200% to 299%, and $\geq$ 300%).

We included community-level variables to capture the ability of localities to support health-related services. In addition to our main independent variable of interest, the proportion of the local population without health insurance coverage, we adjusted for community-level median household income, a summary measure of community wealth, and the Gini coefficient, a summary measure of community income inequality. The Gini coefficient ranges from 0 (perfectly equal distribution of income) to 1 (all income in the community goes to one person or household).[26] Community wealth and income inequality have been shown to be related to health care utilization and health outcomes (eg, mortality).[27] Median household income is positively correlated

with the demand for medical care and the level of health. Income inequality could be related to health because it may reflect the degree of social distance across different income groups as well as disparities in community-level spending in health care.[28] Income inequality could also reduce social cohesion, which could affect the likelihood that individuals will support more spending in local public health programs, which may include breast cancer prevention.[29] All of the contextual level variables were estimated using person-level sampling weights designed for site-specific estimates.[18]

Statistical Approach

We used multilevel logistic regression to analyze how mammography screening among both insured and uninsured women was related to community uninsurance. Multilevel logistic regression is ideal for this study because we are interested in an individual-level dichotomous dependent variable and we have both community- and individual-level variables as predictors.[30] The hierarchical model included random effects to account for dependence in the variation in community effects within each of the 60 communities, and it was estimated using the GLLAMM (Generalized Latent, Linear, and Mixed Models) program in Stata 9.2 (StataCorp LP, College Station, TX).[31]

RESULTS

Mammography Screening and Lack of Insurance

Table 1 presents the characteristics of the full sample as well as the characteristics of separate samples of women who had and did not have a mammogram within the last year. Ten percent of women in this age group were uninsured, and 57% of women had a mammogram within the last year. However, screening rates were substantially different across health insurance status. Approximately 60% of insured women had a mammogram within the last year compared with 26% of uninsured women (not shown).

In addition, large and statistically significant sociodemographic differences distinguished women who had a mammogram from those who did not. Women undergoing mammography screening were relatively older, more educated, more likely to be insured, less likely to come from ethnic/racial minority populations, more likely to be married, and had higher income and better self-reported health.

Table 1. Sample Rates and Means for Women Age 40 to 69 Years, by Mammography Screening

Variable	All	Mammography Screening: Yes (57.17%)	Mammography Screening: No (42.83%)	P*
Individual-level variables				
Uninsured, %	10.12	4.66	17.41	.00
Age group, %				
40-49 years	43.77	37.39	52.28	.00
50-59 years	32.70	35.50	28.96	.00
60-69 years	23.53	27.11	18.75	.00
Race/ethnicity (%)				
White	75.17	77.11	72.57	.00
African American	11.44	10.97	12.05	.13
Hispanic	9.56	8.57	10.89	.00
Other	3.84	3.35	4.48	.03
Years of education, %				
≤ 11	13.39	11.21	16.30	.00
12	35.31	35.17	35.50	.76
13-15	28.06	27.98	28.16	.86
≥ 16	23.24	25.63	20.05	.00
Married, %	62.65	66.47	57.56	.00
Family poverty level, %				
0-99	10.52	8.19	13.63	.00
100-199	14.07	11.60	17.35	.00
200-299	16.43	15.59	17.55	.05
≥ 300	58.98	64.61	51.47	.00
Self-reported health status, %				
Fair	14.24	13.30	15.50	.02
Poor	5.50	4.88	6.34	.01
Good	28.28	27.56	29.25	.14
Very good	35.70	36.86	31.83	.00
Excellent	17.27	17.41	17.08	.70
Chronic health conditions, %				
No chronic conditions	36.46	32.97	41.12	.00
One chronic condition	25.41	26.88	23.45	.00
Two or more chronic conditions	38.13	40.15	35.43	.00
Community-level variables				
Community uninsurance, %	12.51	12.31	12.78	.00
Median household income/$1,000	40.47	40.70	40.16	.07
Gini coefficient	0.41	0.41	0.41	.67

*Wald test of differences in rates and means by mammography screening.

Multilevel Logistic Regression Model of Mammography Screening

Table 2 reports the results from a multilevel logistic model of mammography screening for women age 40 to 69 years. Model 1 reports the results including individual health insurance status and the percentage uninsured in the community (divided by 10). Uninsured women were substantially less likely to have undergone mammography than insured women (odds ratio [OR] = 0.23; 95% CI, 0.19 to 0.28). High community uninsurance rate was also associated with a lower mammography screening propensity (OR = 0.87; 95% CI, 0.83 to 0.90).

Model 2 includes individual demographic and socioeconomic characteristics (years of age, race/ethnicity and years of education, marital status, family poverty level, self-reported health status, and number of chronic health conditions). Model 3 adds community-level characteristics (median household income divided by $1,000 and the Gini coefficient, an index of community income inequality) to the multilevel logistic regression model. Even after adjusting for individual health insurance coverage as well as other individual and community-level characteristics, a 10-percentage-point increase in the proportion of the local population without health insurance coverage is associated with a 17% decrease in the odds that a woman age 40 to 69 years will undergo mammography screening within a year (OR = 0.83; 95% CI, 0.79 to 0.87).

The three multilevel models were also estimated with an interaction term between individual health insurance status and community uninsurance, but the coefficient was statistically insignificant in all three specifications. Thus, the community uninsurance effect on mammography screening did not vary by health insurance status. Another important issue is that mammography screening is not universally endorsed for women age 40 to 49. To address this concern, the statistical analyses were repeated excluding this age group but the main results did not change.

Figure 1 graphs the relation between the community-level weighted-mean predicted probability of undergoing mammography screening and the proportion of the population without health insurance coverage in each of the 60 CTSHS communities. These probabilities are adjusted using the estimated multilevel logistic regression

Table 2. Adjusted Odds Ratios of Undergoing Mammography Screening Within the Last Year, Women Age 40 to 69 Years

Characteristic	Model 1		Model 2		Model 3	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Uninsured	0.23†	0.19 to 0.28	0.31†	0.25 to 0.37	0.31†	0.25 to 0.37
% uninsured in community/10	0.87†	0.83 to 0.90	0.86†	0.83 to 0.90	0.83†	0.79 to 0.87
Age, years						
40-49			Ref		Ref	
50-59			1.70†	1.57 to 1.84	1.70†	1.57 to 1.84
60-69			1.96†	1.72 to 2.25	1.97†	1.72 to 2.26
Race/ethnicity						
White			Ref		Ref	
African American			1.16*	1.03 to 1.32	1.14*	1.00 to 1.31
Hispanic			1.23*	1.04 to 1.46	1.26*	1.05 to 1.51
Other			0.88	0.68 to 1.14	0.89	0.68 to 1.15
Years of education						
≤ 11			Ref		Ref	
12			1.23†	1.05 to 1.43	1.23*	1.04 to 1.47
13-15			1.22†	1.05 to 1.41	1.22*	1.05 to 1.43
≥ 16			1.45†	1.23 to 1.71	1.46†	1.23 to 1.74
Married			1.33†	1.20 to 1.47	1.32†	1.19 to 1.46
Family poverty level, %						
0-99			Ref		Ref	
100-199			0.99	0.83 to 1.19	0.99	0.83 to 1.19
200-299			1.14	0.99 to 1.32	1.14	0.98 to 1.33
≥ 300			1.37†	1.16 to 1.61	1.38†	1.15 to 1.64
Self-reported health status						
Fair			0.90	0.75 to 1.09	0.90	0.75 to 1.09
Poor			0.78*	0.62 to 0.98	0.78*	0.63 to 0.97
Good			0.90	0.77 to 1.05	0.90	0.77 to 1.04
Very good			1.09	0.97 to 1.23	1.09	0.97 to 1.23
Excellent			Ref		Ref	
No. of chronic health conditions						
0			Ref		Ref	
1 chronic condition			1.34†	1.19 to 1.50	1.33†	1.19 to 1.50
≥ 2			1.38†	1.21 to 1.59	1.38†	1.20 to 1.59
Median household income/$1,000					1.01†	1.01 to 1.02
Gini coefficient					1.05†	1.04 to 1.06

Abbreviation: Ref, reference value.
*Statistically significant at the .05 level.
†Statistically significant at the .01 level.

parameters, and they take into account the estimated random effects. The fitted line clearly shows that the mammography screening probability is negatively related to community uninsurance. The slope of the fitted line suggests that, if community uninsurance increases by 10 percentage points, then the community-level weighted-mean probability of mammography screening would fall by 0.064 points.

The community uninsurance elasticity for mammography screening can be estimated at the sample means by multiplying the slope of the fitted line by the mean community uninsurance rate divided by the mean predicted probability of mammography screening. This unit-free elasticity measure is equal to –.13, which suggests that the probability of mammography screening falls by 1.3% for every 10% increase in community uninsurance.

DISCUSSION

A growing body of literature demonstrates the association between individual-level uninsurance and worse health care and health outcomes. This study shows that lack of insurance within a community is associated with reduced mammography use among women in this community, regardless of whether these women are themselves insured. These effects are large and important. The effects are large, because every one-percentage-point decrease in community insurance rates is associated with a 2% decrease in the likelihood of individual mammography use among insured or uninsured women. The results are important because they demonstrate that uninsurance is not just a problem for the uninsured, but it is a dilemma for everyone in society regardless of individual health insurance status.

Most studies about the negative consequences of uninsurance focus on its association with lower access to health care and poorer health. These studies do not consider how local health care systems are stressed by lack of community insurance or, more generally, how uninsurance is a social ill that affects broad and seemingly protected populations.[32,33]

This study is subject to several limitations. The definition of a community in the CTSHS is a relatively large collection of counties or

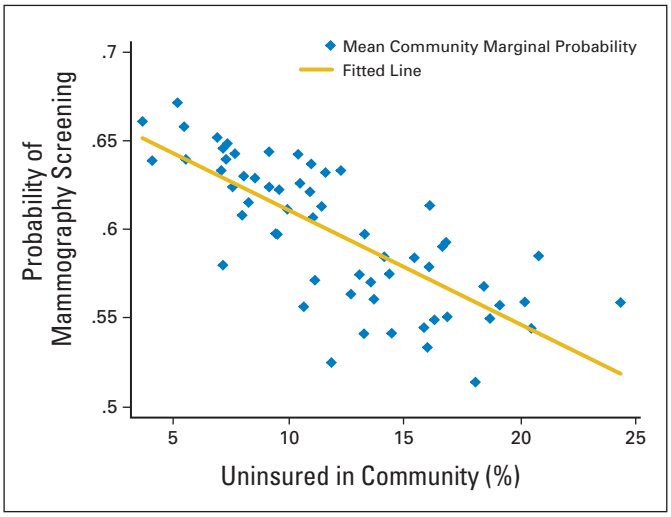

Fig 1. Probability of undergoing mammography screening by percentage of uninsured in a community.

a metropolitan area, and it is unclear what would be the appropriate community size when one studies a preventive health care service such as mammography screening. However, larger sampled community sizes would likely understate the true effects of community uninsurance. Second, our data rely substantially on self-report, and some informants may incorrectly report insurance status or receipt of mammography. Third, the Centers for Disease Control and Prevention provide funding for mammography screening services to low-income women who are uninsured or underinsured through the National Breast and Cervical Cancer Early Detection Program. The availability of these types of programs may affect the results of this study given that this information is not available in the CTSHS.

This study also has several strengths. We carefully adjusted for known individual and community factors that might be associated with mammography, and our statistical models reflected the nesting of individuals within communities. We used data broadly representative of the US population. Our models and hypotheses were grounded in theory derived from plausible mechanisms about the interplay between community factors and individual outcomes.

Long after the individual harms of tobacco use were well established, reductions in tobacco use received their biggest boost when evidence emerged that maternal smoking harms the fetus, and that passive inhalation of tobacco smoke harms nearby nonsmokers. Similarly, researchers have been amassing information about the individual harms of uninsurance, and now we are seeing increasing evidence that uninsurance hurts even the insured.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design: José A. Pagán, David A. Asch, Cynthia J. Brown, Katrina Armstrong
Collection and assembly of data: José A. Pagán
Data analysis and interpretation: José A. Pagán, David A. Asch, Cynthia J. Brown, Carmen E. Guerra, Katrina Armstrong
Manuscript writing: José A. Pagán, David A. Asch, Cynthia J. Brown, Carmen E. Guerra, Katrina Armstrong
Final approval of manuscript: José A. Pagán, David A. Asch, Cynthia J. Brown, Carmen E. Guerra, Katrina Armstrong

REFERENCES

1. DeNavas-Walt C, Proctor BD, Lee CH: Income, Poverty, and Health Insurance Coverage in the United States: 2006 US Census Bureau, Current Population Reports, P60-233. Washington, DC, US Government Printing Office, 2007

2. Rowland D: Uninsured in America [statement for US House of Representatives, Committee on Ways and Means, Subcommittee on Health, March 9]. Menlo Park, CA, Kaiser Family Foundation, 2004

3. Gilmer T, Kronick R: Calm before the storm: Expected increase in the number of uninsured Americans. Health Aff (Millwood) 20:207-210, 2001

4. Institute of Medicine: Committee on the Consequences of Uninsurance: Insuring Health Care Without Coverage—Too Little, Too Late. Washington, DC, National Academies Press, 2002

5. Ayanian JZ, Weissman JS, Schneider EC, et al: Unmet health needs of uninsured adults in the United States. JAMA 284:2061-2069, 2000

6. Roetzheim RG, Pal N, Tennant C, et al: Effects of health insurance and race on early detection of cancer. J Natl Cancer Inst 91:1409-1415, 1999

7. Coughlin SS, Uhler RJ, Bobo JK, et al: Breast cancer screening practices among women in the United States, 2000. Cancer Causes Control 15:159-170, 2004

8. Hsia J, Kemper E, Kiefe C, et al: The importance of health insurance as a determinant of cancer screening: Evidence from the Women's Health Initiative. Prev Med 31:261-270, 2000

9. Fronstin P: Sources of Health Insurance and Characteristics of the Uninsured: Analysis of the March 2002 Current Population Survey—EBRI Issue Brief 252. Washington, DC, Employee Benefit Research Institute, 2002

10. Fisher R: County and state health insurance coverage estimation [working paper, July 2005]. Washington, DC, US Census Bureau, 2005

11. Thorpe KE: Protecting the uninsured. N Engl J Med 351:1479-1481, 2004

12. Lipscomb J: Managed care market penetration, spillover effects, and the quality of cancer care. J Natl Cancer Inst 97:242-244, 2005

13. Baker LC, Brown ML: Managed care, consolidation among health care providers, and health care: Evidence from mammography. Rand J Econ 30:351-374, 1999

14. D'Orsi C, Tu SP, Nakano C, et al: Current realities of delivering mammography services in the community: Do challenges with staffing and scheduling exist? Radiology 235:391-395, 2005

15. Center for Devices and Radiological Health, US Food and Drug Administration, 2007. www.fda.gov/cdrh

16. American Cancer Society: Breast Cancer Facts & Figures 2005-2006. Atlanta, GA, American Cancer Society, 2006

17. Pagán JA, Pauly MV: Community-level uninsurance and the unmet medical needs of insured and uninsured adults. Health Serv Res 41:788-803, 2006

18. Center for Studying Health System Change: Community Tracking Study Household Survey, 2000-2001 [computer file], 3764, ICPSR Version. Ann Arbor, MI, Inter-University Consortium for Political and Social Research, 2003

19. Nelson DE, Thompson BL, Davenport NJ, et al: What people really know about their health insurance: A comparison of information obtained from individuals and their insurers. Am J Public Health 90:924-928, 2000

20. Thompson BL, Nelson DE, Davenport NJ, et al: The validity of self-reported health care coverage information. Assoc Health Serv Res Meet 15:198, 1998 (abstr)

21. Thompson B, Taylor V, Goldberg H, et al: Mammography status using patient self-reports and computerized radiology database. Am J Prev Med 17:203-206, 1999

22. McGovern PG, Lurie N, Margolis KL, Slater JS: Accuracy of self-report of mammography and pap smear in a low-income urban population. Am J Prev Med 14:201-208, 1998

23. Zapka JG, Bigelow C, Hurley T, et al: Mammography use among sociodemographically diverse women: The accuracy of self-report. Am J Public Health 86:1016-1021, 1996

24. Andersen RM, Davidson PL: Improving access to care in America: Individual and contextual indicators, in Andersen RM, Rice T, Kominski G (eds): Changing the US Health Care

System: Key Issues in Health Services, Policy and Management. San Francisco, CA, Jossey-Bass, 2001

25. Andersen RM, Yu H, Wyn R, et al: Access to medical care for low-income persons: How do communities make a difference? Med Care Res Rev 59:384-411, 2002

26. Williams RF, Doessel D: Measuring inequality: Tools and an illustration. Int J Equity Health 5:5, 2006

27. Subramanian SV, Blakely T, Kawachi I: Income inequality as a public health concern: Where do we stand? Health Serv Res 38:153-167, 2003

28. Kawachi I, Kennedy BP: Income inequality and health: Pathways and mechanisms. Health Serv Res 34:215-227, 1999

29. Kawachi I, Berkman LF: Social cohesion, social capital, and health, in Kawachi I, Berkman LF (eds): Social Epidemiology. New York, NY, Oxford University Press, 2000

30. Diez Roux AV: Investigating neighborhood and area effects on health. Am J Public Health 91:1783-1789, 2001

31. Skrondal A, Rabe-Hesketh S: Generalized Latent Variable Modeling: Multilevel, Longitudinal, and Structural Equation Models. Boca Raton, FL, Chapman & Hall/CRC, 2004

32. Institute of Medicine: Committee on the Consequences of Uninsurance: A Shared Destiny—Community Effects of Uninsurance. Washington, DC, National Academies Press, 2003

33. Cunningham PJ, Kemper P: The Uninsured Getting Care: Where You Live Matters—Issue Brief (Center for Studying Health System Change). Washington, DC, Health System Change, 1998

Acknowledgment

We thank José E. Olivares and Lakshmi Balasubramanian for providing excellent research assistance.

